

(1) hybrid cock  $\times$  jungle hen, (2) hybrid hen  $\times$  domestic cock, (3) hybrid hen  $\times$  jungle cock.

From the cross-bred cock  $\times$  hybrid hen several addled eggs were obtained, four more had chicks dead in the shell, and from two of the eggs live chickens were hatched out. The latter were apparently sturdy and robust enough for a short time, but died on the twelfth and eighteenth day respectively after hatching. The sterility of the hybrids cannot, therefore, be adduced as evidence that the Ceylon jungle fowl is not a parent stock of the domestic fowl. It was pointed out that the Ceylon jungle fowl has a reddish-brown breast, and when reversion occurs among domestic fowls, even those of pure bred black-breasted types, the males usually have red or brown breasts and not black like *Gallus bankiva*.

Mr. F. V. Theobald gave an account of a parasitic liver disease in fowls, specimens of which had been sent to him during the last three or four years. Although previously unrecorded, it is probably quite common, and due to a protozoon *Amoeba maleagridis*, Sm. Diagnosis is somewhat difficult, but the *post-mortem* appearances of the liver with yellow spots along with swollen cæca are characteristic. The life-cycle of the parasite is not yet fully worked out.

Mr. Theobald incidentally referred also to an infectious disease among poultry in South America, produced by a Spirochæte, which passes part of its life-cycle in a fowl tick (*Argas miniatus*). J. P.

#### HYDROLOGY IN THE UNITED STATES. PURIFICATION OF SEWAGE.

WE have on several previous occasions noticed the papers issued by the United States Geological Department on Water Supply and Irrigation.<sup>1</sup> Recently we have been favoured by the receipt of nineteen further papers bearing on this subject.<sup>2</sup>

The greater part of these, although containing a great deal of information bearing on water supply, are yet chiefly of local interest.

Paper No. 180 of the series now sent deals with the efficiency of turbine water-wheels, and consists of a compilation of data derived from tests and from manufacturers' power tables of American stock sizes, and is intended principally for the use of the hydrological surveyors in cases where the turbine is used for gauging streams.

Paper No. 179 gives an account of investigations carried on for the purpose of discovering means for preventing the pollution of streams by distillery refuse. Paper No. 189 further deals with the disposal of the waste liquors resulting from the manufacture of strawboard, an important problem connected with the prevention of stream pollution in the districts where this industry prevails.

Paper No. 187 deals with the measurement of streams when they are frozen over, and with the modifications of the ordinary methods of gauging these streams when they are covered with ice.

Paper No. 182 describes the various wells in use for municipal or domestic supply in Michigan, and the means adopted for raising the water from these wells.

Paper No. 185, on investigations into the purification of

Boston Sewage, with a history of the sewage disposal problem, is of much more general interest, and contains a great deal of information of value to sanitary engineers and chemists engaged in sewage disposal. It therefore deserves a more extended notice in this Journal.

The origin of the paper was as follows:—An anonymous friend of the Massachusetts Institute of Technology, moved by the magnitude and gravity of the sewage disposal problem as it concerns householders and communities, in 1902 presented to the institute a sum equal to 1000l. a year for three years, afterwards extended to five years, for the purpose of making experiments on sewage purification and giving the widest possible publicity to means or methods by which the present too often crude and imperfect systems may be improved.

The report now under review, which contains 162 octavo pages, has been drawn up by Messrs. Winslow and Phelps in consonance with the wishes of the donor, and consists of a popular statement of the history of the several methods that have been tried for the purification of sewage, and a record of the results obtained at the laboratory of the Massachusetts Institute. It is claimed by the authors that the paper is written in a popular style and in language so simple that citizens, boards of health, and sewerage commissions may readily avail themselves of the information contained in it.

The sewage experimental station at the institute is situated adjacent to the City of Boston, U.S.A. Within the last few years the whole of the sewage of this city has been collected into two large main outfall sewers, and is discharged into the harbour on the ebb tide. The station is connected with one of these outfall sewers. The sewage is pumped directly from the sewer through 2½-inch galvanised pipes into a series of twenty-five tanks having an area of 24 feet each, the depths varying from 3 feet to 6 feet. In these tanks the sewage is treated by intermittent sand filtration; the septic process; contact filtration through coke, stone, and brick of various diameters; and by trickling filters. The result of the effluent from the different tanks, as obtained by analysis, is given.

Under the conditions of these experiments crude sewage has been successfully filtered through a 2-feet bed of sand with an effective size of 0.14 millimetre at a rate of 0.4 million gallons per acre per day, divided into four doses in the twenty-four hours. The effluents were clear, bright, and well purified.

With single contact beds of stone 1½ inches in diameter, passed at the rate of 1.2 million gallons per acre per day, the effluent of the crude sewage was only partially purified. The beds clogged rapidly, and the surface required much attention.

The double contact system in primary beds of 2-inch material, and secondary beds of ½ inch, yielded a fairly well-purified and stable effluent at the rate, on the combined double system, of about 0.7 million gallons per acre per day with beds 6 feet deep.

The most practical of the methods that have been studied appears to be the treatment of the sewage either sedimented or subjected to a very short period of septic action in double contact beds.

The process of trickling filtration remains to be considered in a further report, but, so far as the present experiments indicate, this method will probably prove superior to any so far tested.

In the report is also given a summary of the history of sewage purification in England, Germany, the United States, and other countries, and the gradual development of the processes at present in operation. Starting from the discharge of the crude sewage into the sea or rivers, broad irrigation or sewage farming is described, and also chemical precipitation, intermittent filtration through sand, septic tanks, contact process in beds of coarse material, and continuous trickling over coarse material.

With regard to the first, it is shown that, although where the conditions are favourable sewage may be discharged into the sea without creating a nuisance, there yet remains to be considered its effect on shell-fish. With regard to the discharge into rivers, the conclusion arrived at by the River Pollution Commission of 1874 is given, that sewage mixed with twenty times its volume of pure

<sup>1</sup> Water Supply and Irrigation in the United States, January 7, 1904; July 28, 1904; November 3, 1904; December 22, 1904; January 26, 1905; December 21, 1905; March 2, 1906; May 24, 1906.

<sup>2</sup> Reports issued by the Department of the United States Geological Survey. Water Supply and Irrigation Papers. (Washington: Government Printing Office, 1906.) No. 185, Purification of Boston Sewage; No. 179, Prevention of Stream Pollution by Distillery Refuse; No. 180, Turbine Water Wheel Tests and Power Tables; No. 159, Summary of Underground Water Resources of Mississippi; No. 161, Quality of Water in the Upper Ohio River Basin; No. 162, Destructive Floods in the United States in 1905; No. 164, Underground Waters of Tennessee and Kentucky; No. 172, Progress of Stream Measurements, Missouri River; No. 174, Progress of Stream Measurements, Western Gulf of Mexico; No. 175, Progress of Stream Measurements, Colorado River; No. 177, Progress of Stream Measurements, California; No. 179, Means of Preventing Pollution of Streams by Distillery Waste; No. 181, Geology and Water Resources of Owens Valley; Nos. 182 and 183, Flowing Wells and Municipal Water Supplies in the Southern Peninsula of Michigan; No. 184, Underflow of South Platte Valley; No. 187, Determination of Stream-flow during the Frozen Season; No. 188, Water Resources of the Rio Grande Valley in New Mexico; No. 189, The Prevention of Stream Pollution by Strawboard Waste.

water would be two-thirds purified in flowing 168 miles at the rate of one mile an hour. With regard to broad irrigation, the conclusion generally arrived at is that sewage farms can never be expected to show a profit if interest on capital is included in the expenditure, and the experience is that there need be no serious danger of the spread of disease from irrigated crops, but that fruits and vegetables so grown should never be eaten without being cooked. With chemical precipitation the great difficulty is the disposal of the sludge, which amounts to twenty to twenty-six tons per million gallons of sewage. The disposal of this sludge generally involves considerable expense, it being found by practice to be of no value as manure. In fact, in some places, after being compressed into cakes, it is burnt or buried in the ground.

The result of the other processes has already been dealt with in the experiments conducted by the Massachusetts Institute.

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LIVERPOOL.—The annual exhibition of antiquities arranged by the Institute of Archaeology, illustrating excavations in Upper Egypt 1906-7, was inaugurated at Burlington House, London, W., on Tuesday, July 16, and will remain open until July 30. The exhibits include scarabs, ornaments, and inscriptions of 2000 B.C. to 1200 B.C., and stelæ of Ptolemaic and later dates, recently discovered by Prof. Garstang, Mr. E. Harold Jones, and the Hon. R. H. Trefusis.

MANCHESTER.—By the will of the late Mr. Mark Stirrup the university has received the following bequests:—Specimens of volcanic rocks and fossils; 1000*l.* for the maintenance of a geological and palæontological collection; 1500*l.* for the foundation of a palæontological scholarship, tenable for two years by anyone who has studied geology in the university.

Mr. J. W. Bews has been appointed to the newly instituted post of lecturer in economic botany.

OXFORD.—In a convocation to be held on September 30, the degree of D.Sc. *honoris causa* will be conferred upon Prof. Charles Barrois, Lille; Prof. A. Heim, Zürich; Prof. A. Lacroix, Paris; Prof. M. Beck, Berlin; Dr. Hans H. Reusch, Norway; and Prof. F. Zirkel, Leipzig.

Dr. George Oreyer, lecturer in general and experimental pathology in the University of Copenhagen, has been elected to the newly established professorship of pathology.

SHEFFIELD.—The University has just issued its list of results of examinations, and we observe that three students have obtained the new degree of Bachelor of Metallurgy (B.Met.), viz. R. Matheson, K. Woo, and G. S. Ludlam. It seems only appropriate that the University's first three graduates should have taken their degree in metallurgy, as this department has for many years upheld a high standard of training in the metallurgy of iron and steel compatible with the ancient fame of the city as the home of the manufacture of high-class and special steels. It may not be inappropriate to note, in connection with the present trend of affairs in the East, that one of the honour graduates is a native of China.

PRIVATE enterprise has succeeded in founding, with the sanction of the Ministry of Education, confirmed by the Czar, an Institute of Archaeology and Archæography in Moscow. The institute, which has just obtained its charter, ranks with a university, and is open to all graduates of Russian or foreign universities. Its aim is to prepare qualified archaeologists and "archæographists." The latter term is applied to persons skilled in the preservation and use of historical archives, libraries, museums, and other collections, public and private, demanding special knowledge. The Moscow Institute of Archaeology is the first institution in Russia founded on autonomous principles; it has the right to elect its own staff of professors, and generally to conduct its own internal affairs, subject only to a possible veto of the Minister of Education in certain cases. The course is a three years' one, the final year of which must be spent in practical work either in archaeological expeditions and research among the

monuments of antiquity as yet so little studied in Russia, or in similar special work at home or abroad. The institute grants the degree of doctor of archaeology or archæography. Among those connected with the new institute whose names are favourably known outside Russia may be mentioned Dr. Uspensky, director of the institute, the author of fifty capital monographs in Russian; Dr. Fleischer, who was associated with English and American archæologists in recent excavations in Persia; Prof. Grot, and other Moscow professors. Privat-docent Visotsky has been appointed secretary to the institute.

THE first meeting of the governing body of the Imperial College of Science and Technology was held on July 12 at the Victoria and Albert Museum, South Kensington. Mr. R. McKenna, M.P., President of the Board of Education, who was accompanied by Sir Robert Morant, opened the meeting. The following members of the governing body were present:—The Earl of Crewe, Sir F. Mowatt, Sir Julius E. Wernher, Sir W. H. White, Principal MacAlister, Mr. A. H. D. Acland, Mr. F. G. Ogilvie, Mr. J. C. G. Sykes, Dr. Glazebrook, Sir E. H. Busk, Prof. Capper, Prof. Farmer, Sir A. W. Rücker, Mr. A. Acland Allen, M.P., Mr. H. Percy Harris, Sir C. Kinloch-Cooke, Mr. R. A. Robinson, Mr. J. T. Taylor, Sir J. Wolfe-Barry, Sir Owen Roberts, Sir W. S. Prideaux, Viscount Esher, Sir A. Geikie, Prof. Tilden, Prof. Gowland, Prof. Dalby, Sir Alexander Kennedy, Mr. T. Hurry Riches, Mr. R. K. Gray, Sir Hugh Bell, Dr. Elgar, Prof. Divers, Mr. A. Sopwith, and Mr. W. McDermott, with Mr. F. E. Douglas as secretary (*pro tem.*). Mr. McKenna, in opening the meeting, took the opportunity to explain the arrangements which would have to be made for the transfer of the Royal College of Science and Royal School of Mines to the control of the governing body, and referred to the importance of the work which lay before the governing body in connection with the provision and organisation of advanced technical education within the Empire. On the motion of Viscount Esher, seconded by Sir Alexander Kennedy, Lord Crewe was unanimously elected chairman. On Lord Crewe taking the chair, Mr. McKenna handed to him the Letters Patent containing the Grant of the Charter of the Imperial College. Provisional committees (including a finance committee, of which Sir F. Mowatt was appointed chairman) were appointed to deal with preliminary matters and to report to the next meeting of the governing body, which was fixed for July 19.

A RECENT issue of the Journal of the Department of Agriculture and Technical Instruction for Ireland contained an exhaustive article on technical instruction in Belfast, by Mr. F. C. Forth, the principal of the municipal technical institute in the city. This account has now been published in a separate form. In the inauguration of the scheme of technical instruction the Corporation had as the chief object the provision of instruction in the principles of those arts and sciences bearing upon the trades and industries of Belfast. The success of the trade classes has been due in great measure to the enlightened view which officers of trade societies in Belfast have taken of the operations of the technical institute and to the encouragement which has been given by employers. In 1900 it was decided to build the excellent technical institute which has now been practically completed at a cost of 100,000*l.* The Belfast Corporation was, it is satisfactory to note, well advised, and as the work of each department developed sufficiently to warrant such a step, a principal teacher for it was appointed, and his first duty was to superintend the equipment of the department allotted to him in the new building and to be responsible for the expenditure of his share of the 40,000*l.* set aside for the equipment of the new institute. Before the building was out of the contractor's hands a number of classes were transferred to it, and useful experience was gained which led to some modifications in arrangements before the building was completed finally. The great bulk of the equipment is now installed, and it is hoped that when the date for the formal opening arrives, the building and its contents will be complete. Belfast is to be congratulated upon the provision the Corporation has made for providing young men and women with a modern and thorough type of technical education.